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PROJECTS IN IMAGINATIVE NATURE EDUCATION, SURVEY REPORT AND OUTDOOR LABORATORY PLAN.

NATIONAL AUDUBON SOCIETY, NEW YORK, N.Y.

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THIS PLAN SUGGESTS HOW THE MID HUDSON-CATSKILLS MUSEUM CAN WORK CREATIVELY WITH COOPERATING SCHOOL DISTRICTS TO STRENGTHEN THEIR CURRICULUMS THROUGH OUTDOOR EDUCATION. THE RESULT OF THIS COOPERATIVE ENDEAVOR IS TO BE AN OUTDOOR LABORATORY CALLED "GATEWAY CENTER" LOCATED NEAR NEW PALTZ, NEW YORK. PART 1 CONTAINS (1) BACKGROUND INFORMATION, (2) OBJECTIVES OF AN OUTDOOR INTERPRETIVE PROGRAM, AND (3) DESCRIPTIVE DATA, INCLUDING GENERAL GEOLOGICAL AND ECOLOGICAL CHARACTERISTICS OF THE PROPERTY LEASED FOR THE PROJECT. PART 2 CONTAINS (1) STATEMENTS OF USES WHICH ARE COMPATIBLE AND INCOMPATIBLE TO AN OUTDOOR LABORATORY, (2) DESCRIPTIONS OF NECESSARY IMPROVEMENTS TO IMPLEMENT THE EDUCATIONAL AND RECREATIONAL PROGRAM, AND (3) A DESCRIPTION OF SUGGESTED PROGRAM OFFERINGS. APPENDED ARE (1) SUGGESTED PRINCIPLES OF CONSERVATION TO BE STRESSED AND RECOMMENDED METHODS OF ILLUSTRATION, (2) TIPS FOR FIELD TRIP FUN, AND (3) SUGGESTIONS FOR HABITAT MAINTENANCE AND IMPROVEMENT INCLUDING SPECIFIC MANAGEMENT PRACTICES FOR SELECTED BIRD AND ANIMAL SPECIES. (DS)

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SURVEY REPORT
&
OUTDOOR LABORATORY PLAN

PROJECTS IN IMAGINATIVE NATURE EDUCATION
(PINE)

An E.S.E.A. 1965, Title III Project
located at

GATEWAY CENTER

of
Mid Hudson-Catskills Museum
New Paltz, New York

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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NATIONAL AUDUBON SOCIETY
Nature Centers Division
1130 Fifth Avenue, New York, N. Y. 10028

SE 004 305

Survey Report

and

Outdoor Laboratory Plan

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(PINE)

An E. S. E. A. 1965, Title III Project

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GATEWAY CENTER

of

Mid Hudson-Catskills Museum

New Paltz, New York

Prepared for

Mid Hudson Regional Supplementary Educational Center

Ulster County B.O.C.E.S.

175 Rt. 32 N., New Paltz, N.Y. 12561

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NATIONAL AUDUBON SOCIETY
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Preface

The survey and outdoor laboratory plan is a proposal to suggest the manner in which the Mid Hudson-Catskills Museum can work creatively with cooperating school districts to strengthen their curriculums through the educational use of the outdoors.

The presentation is in three sections with Part I containing background information and objectives of an outdoor interpretive program. Part II is a report on the site survey of the Gateway Center and a presentation of an overall plan for the development of the outdoor laboratory. Part III consists of appendices which support the general text of the report.

NATIONAL AUDUBON SOCIETY
Nature Centers Division
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Planning Engineer

January 20, 1967

PART I

BACKGROUND INFORMATION

GENERAL PERSPECTIVE

The purpose of an outdoor laboratory is to provide enriching first-hand experiences which cannot be structured or furnished for students within the walls of the regular classroom. The use of such an outdoor laboratory is not meant to duplicate or replace any part of the regular classroom program. The major emphasis in an outdoor laboratory situation centers around the problem-solving approach. Key elements in this method of teaching are: (1) involving students in formulating questions they might have about an area of concern, (2) speculating as to what they think the answers might be, (3) gathering pertinent information, (4) following with investigation, and (5) reaching conclusions. Once the students are able to arrive at tentative conclusions, they will have strengthened many concepts which they can fit into previous learning and transfer to new or similar situations.

An outdoor laboratory is unique in providing for a range of study activities. The natural setting is the sum and substance of the outdoor laboratory, always available for discovery and exploration. From carefully developed plans and objectives originating in the classroom, students and teacher embark on an adventure into the outdoors. Following this direct involvement of the group in the outdoors, the search for gaining meaning continues in the outdoors, as sensory experiences become the motivation and guide to investigative activities. This in turn provides direction for further study in the classroom where appropriate means are employed to continue, evaluate and expand learning. Thus, the outdoor experience grows out of the classroom and leads back to the classroom as an integral part of the school curriculum. It becomes apparent then that the key professional person involved in the use of the outdoor laboratory is the classroom teacher, assisted by specialized personnel.

The primary objectives of an outdoor laboratory which seem important here are:

- To develop an appreciation and awareness of the values of our natural surroundings, i.e., educational, scientific, recreational, esthetic and economic
- To develop and encourage moral and civic responsibility

for the wise and best use of natural resources

- To encourage the personal use of the natural environment to maintain proper physical and emotional well-being

- To promote continuing curiousity and lifelong interest in natural resources for avocational and vocational purposes

- To develop the powers of perception as avenues of learning through involvement of all senses (sight, hearing, taste, touch, muscular tension.)

- To provide educational experiences which bridge the chasm between the classroom and the outdoors

- To promote good field trip planning through orientation and follow-up activities in the classroom

- To encourage creative and constructive thinking in experimentation and problem solving

- To develop the ability to reason by observing facts

- To develop an awareness that all things in nature change constantly

- To provide a better understanding of the interdependence of all facets of nature, with particular emphasis on ecological relationships.

GATEWAY CENTER

This part of the report contains information and data relative to the property on lease from the Mohonk Trust to PINE, a Title III project. Pertinent information will be given on the location of the land, accessibility, size and shape, terrain and general characteristics, a review of the natural and

other resources of the area and important human factors. Where appropriate, brief recommendations will conclude each section.

Location

The site, designated as the Gateway Center for the PINE project, is located about 1½ miles west of New Paltz, New York. The area, as shown on Map #1 on the next page, is situated in Ulster County near the Wallkill River.

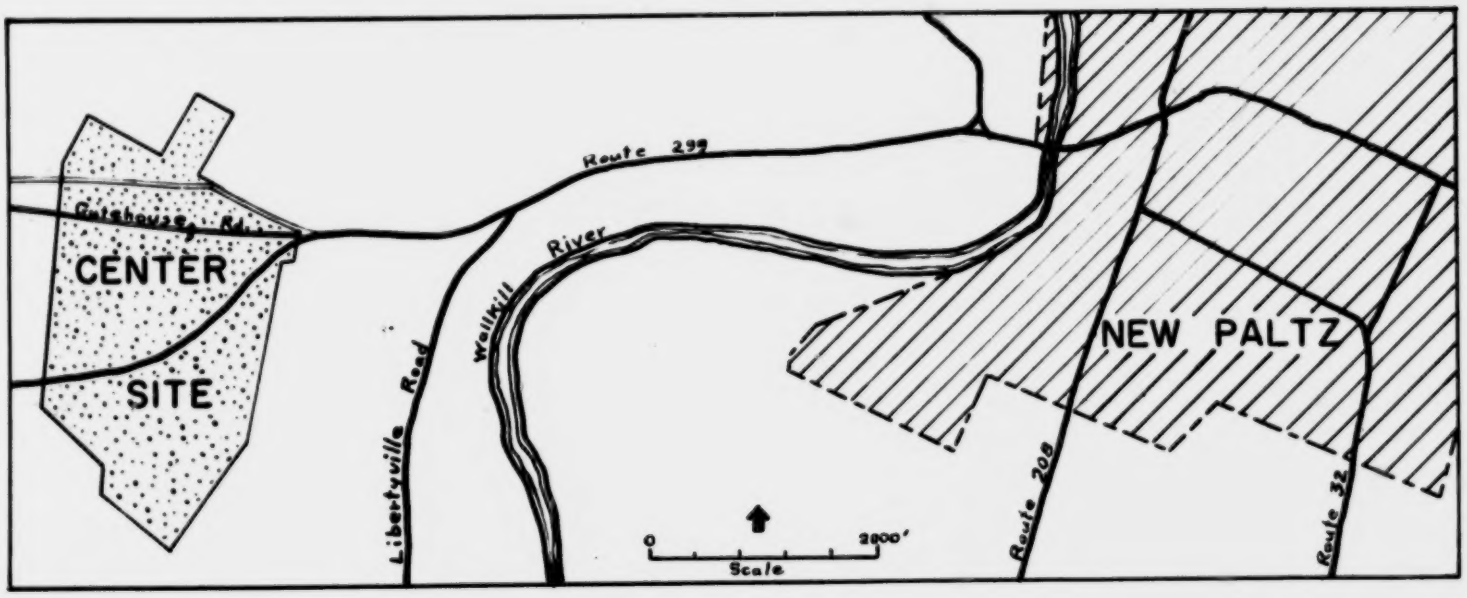
Accessibility

The Gateway Center has good accessibility by car and bus on many highways from all parts of the area to be served. The area consists of the counties of Orange, Sullivan, Ulster, Dutchess, Putnam and Westchester (in part).

Terrain and General Characteristics of the Land

Varied terrain is important for a successful outdoor laboratory program. Diversified topography affords the opportunity to teach several aspects of natural history as it relates to local geological features. In general the Gateway Center is gently rolling with several low, wet depressions. Drainage channels are broad and relatively flat resulting in poor drainage of surface waters. The range of elevation is from 260 to 320 feet above sea level, making a difference of

LOCATION MAP
for the
GATEWAY CENTER
MID HUDSON-CATSKILLS MUSEUM



MAP NO. I.

only 60 feet between the lowest and highest points on the property. Large erratic surface boulders which were moved into the area by glacial forces are common on the site.

Water Resources

The presence of "hardpan" or clay near the surface of the land produces generally wet conditions over much of the site. Several woodland swamps add diversity to the outdoor laboratory. Two irregularly shaped ponds were dug several years ago on an intermittent stream near the entrance to the Gateway Center, and are very valuable for wildlife and as rich habitats to observe and study.

It is recommended that about a dozen waterholes be dug or blasted in wet areas of the site. These should be carefully located so as to be naturally filled with water during as much of the year as possible and be of varying sizes to hold from 15 to 50 barrels of water each. It is further suggested that these waterholes be "planted" with several kinds of amphibian eggs in order to establish these interesting forms more universally on the site.

By blocking the drain at the edge of the north field, another small body of water and marsh could be created. Due to the lay of the land, the water would be shallow and ideal

for cattail growth. Control measures might have to be used against the loosestrife which seems to dominate nearby shallow water areas.

Geologic and Soil Resources

The outdoor laboratory lies in the Hudson-Champlain section of the Ridge and Valley Province. This geologic province is one of folded mountains in which resistant strata form ridges, and weaker rocks are worn down to lowlands.

The center property lies between the Shawangunk Mountains to the west and the Wallkill River lowlands to the east. The river flows northeast to its confluence with the Hudson River. The valley floor has been carved into hills which are mainly pre-glacial, though modified by the glacial ice. The Shawangunk Mountain is a monoclinal ridge of Medina and Clinton conglomerate and sandstone which dips northwestward, at places almost vertically. The broad, high portion in this area was overridden by the continental ice which polished the rocks and left such well-known lakes as Mohonk and Minnewaska. Most of the glacial activity was mainly that of the last or Wisconsin stage.

The soils are generally of glacial origin with a thin glacial mantle closely related to the underlying rock forma-

tions of thick-bedded calcareous sandstone. The glacial ice which swept over the site from the north carried with it many kinds of foreign materials which mixed with local materials. Erratic boulders of conglomerate and limestone are found widely scattered across the landscape of Gateway Center.

Four major soils were noted in the vicinity of the outdoor laboratory which lies within the belt of the Gray-Brown podzolic soils of the United States. They are as follows:

> Hudson silt loam. Consists of light yellowish-brown finely-granular silt loam of rather heavy texture. At a depth of 30 inches this material gives away to brown silty clay. The lower part of the subsoil and the substratum are rich in lime.
>
> Hudson silt loam (imperfectly drained phase). Occurs in many nearly flat or broad, slightly depressed areas and has a slightly darker surface with noticeable mottling at a depth of 8-20 inches.
>
> Albia gravelly loam. Consists of light-brown or slightly yellowish-brown fine gravelly loam to a depth of about 8 inches. Subsoil is mottled, more friable and gravelly.
>
> Orono silty clay loam. Developed under imperfect and poor drainage conditions; consists of very dark gray to black, decidedly granular heavy silt to a depth of about 10 inches.

Forest and Other Ground Cover Resources

The forested areas found on the Gateway Center can be divided into five distinct general forest associations. They are: (1) mixed oak, (2) oak hickory, (3) swamp hardwoods,

(4) red cedar, and (5) sugar maple. The mixed oak, oak-hickory and sugar maple types can be more broadly classified as northern hardwoods.

The forest resources vary from stand to stand. For the purposes of this report the stands have been identified by tree height, size and composition, and are described as follows, being designated by capital letters. These stands are similarly designated on Map #2 on page 18.

A. Young oak-hickory. The trees are 4-10 inches DBH (diameter breast high) and average 60 years in age. Scattered throughout are a few 12- to 14-inch trees. The chief species are white oak, red oak, shagbark hickory, pignut hickory, sugar maple, white ash, chestnut oak, pin oak and red maple. Pure stands of oak and sugar maple are located here.

B. Red cedar. Old fields have reseeded naturally to red cedar stands with mixtures of scotch pine, gray birch, oak hickories, maples, elm, and a variety of shrubs. The stands vary in size, height, age, density and composition. The older cedars are at least 40-50 years in age. A small stand of gray birch (B1) is located near the pond and the trees are now crowded out and are dying. To continue this species it will be necessary to cut out all competing trees.

C. Swamp hardwoods. The stand contains pin oak, swamp white oak, red maple, white oak and elm, 6-20 inches DBH.

D. Mixed hardwoods. A mixture of nearly all the local hardwood species is found growing in the stand. The trees range 6-16 inches in diameter with a few up to 24 inches.

E. Mature oak-hickory. This small area of older timber has trees 14-22 inches DBH. Some of the largest and best

trees of the outdoor laboratory are found in the stand.

F. Planted scotch pine. The scotch pine trees were planted about 40 years ago with trees now 4-10 inches in diameter. To insure maximum growth and development, the stand should be thinned. In the plantations, half of the stand can be thinned and the other half can be left unthinned for comparison and study.

G. Mixed oak-scotch pine. This was an old field area that had been planted to scotch pine but probably contained a mixture of cedar and hardwood trees at the time of the planting.

H. Old field-natural reseeding. The area represents the most recent field to be turned back to nature, an excellent area in which to see the early stages of natural succession. In addition to weeds and grasses, a mixture of pine, cedar, shrubs and a few oaks, hickories and maple are now established. The density of trees varies in relationship to distance from a seed source.

I. Planted sugar maple. Several rows of sugar maples were planted to separate the fields from lawn areas. The trees are limby with wide-spreading crowns and range 14-18 inches DBH.

J. Mixed shrubs-hardwoods. Years ago organic soil was removed for the Mohonk gardens, leaving two very interesting wildlife ponds. A mixture of weeds, grasses, cattails, shrubs and trees are now established around its edges and on the islands.

K. Old swamp-mixed shrubs. In order to drain nearby fields, a ditch was dug along the west side of the swampy area and resulted in a change of the plant ecology. The area now supports a mixture of shrubs, and scattered hardwood. By blocking the ditch in a number of places, this area could be returned to a swampy condition.

L. Planted pin oak. The private roadway is lined with large pin oaks. Some trees have died out, and others are showing signs of decay due to old age.

M. Big-tooth aspen. This small aspen stand is being gradually crowded out by the more dominant oaks and hickories. To preserve the aspens for study purposes, it will be necessary to remove the more competitive species within and surrounding the area.

Table 1 on the next page lists the trees, shrubs, wildflowers, ferns and other plants identified during the field survey.

Table 1

Trees, Shrubs, Wildflowers, Ferns, Other Plants

Trees

white oak
swamp white oak
chestnut oak
northern red oak
black oak
pin oak
chinkapin oak
quaking aspen
big-tooth aspen
American hornbeam
scrub oak
sugar maple
red maple
white ash
black ash
American elm
slippery elm
rock elm
gray birch
white birch
hop hornbeam
sweet pignut hickory
scotch pine
white pine
red cedar
hemlock
shagbard hickory
pignut hickory
black cherry
black willow
black birch
Norway spruce

Shrubs

deciduous holly
staghorn sumac
smooth sumac
bristley black currant
spreading juniper
blackberried elder
red-osier dogwood
flowering dogwood
silky dogwood
nannyberry
snowberry
chokecherry
blueberry
ninebark
thornapple

Wildflowers

sticktights
brown-eyed susan
wild strawberry
loosestrife
wild geranium
dandelion
pasture rose
wintercress
burdock
hepaticas
Canadian thistle
trailing arbutus
St. Johnswort
goldenrod
milkweed
yarrow
knotweed
selfheal
wild carrot

Ferns

ebony spleenwort
walking
Christmas
northern beech
sensitive
marginal wood

Mosses and Clubmosses

hair-cup moss	tree moss	ground cedar
pin-cushion moss	running pine	savin-leaved clubmoss

Vines and Brambles

grape	blackberry	multiflora rose
poison ivy	black raspberry	

The diverse character of plant cover on the site is further enhanced by the micro-plant communities that have developed on the scattered glacial boulders and under stands of red cedar. The predominant plant in this consideration is the lichen, a curious partnership of algae related to the green stains on tree trunks and of fungi related to bread mold.

These two plants demonstrate a complex interrelationship involving exchanges of chemicals as well as the more traditionally known manufacture of food by the green member of the pair, the alga, and the absorption of water by the enveloping fungus.

Lichens are so numerous on the site that they merit further mention here. Persons interested in these pioneer plants could easily spend several weeks of study in the area. Lichens take three forms of outward appearance: (1) Crustose--granular (dust-like), thin layers on rocks or tree trunks, (2) Foliose--leafy, plate-like or lobed bodies, and (3) Fruticose, or shrubby forms which may be unbranched spikes or cups

or knobbed clubs or branched and intertangled stalks.

Lichens have long been used as a source of dyes; Harris tweeds and litmus paper are familiar examples of the products of such dyestuffs. Some can be used as food for humans in emergencies; others are more poisonous and in fact have been used in poisons for animal control. A few are very important in the perfume trade, being used to make the many ingredients which evaporate together with pleasant effects. Some are used in the manufacture of antibiotics.

Lichens are the pioneers for other vegetation. Finding lodgment on the barren boulders, as they do, they proceed by acid secretions to the chemical breakdown of the rock material, thus gradually helping to make soil in which other plants can later grown. Therefore on a single boulder it is sometimes possible to find the whole story of soil making and plant succession.

The following species of lichens were identified during a rather brief examination of a few boulders and a small area of soil under a red cedar stand: smooth rock tripe, red-fruited pyxie cup, [illegible]uited pyxie cup, reindeer "moss", awl, power horn, sc[illegible]rested or British soldier, brown-crested, pagoda or organ pipe, wolf, wrinkled shield, gray star and boulder.

Human Resources

More than 555,500 people are currently living in the area to be served by the Gateway Center Outdoor Laboratory. Of this number about 185,000 or 33% attend public and private schools of the area. Statistical information on the population is given in Table 2. It seems very clear that there are enough people in the 5-plus county area to make good use of the outdoor laboratory facilities of the Gateway Center, on existing school grounds and on future nature center sites.

Table 2

Human Factors

Project PINE Area

Population (estimated) 555,540

School Enrollment--1965-1966

	Public	Non-Public
Elementary	96,682	17,418
Secondary.	67,318	2,780
Totals.	.164,000	20,198
Grand total.		.184,198

PART II

SUGGESTED OUTDOOR LABORATORY PLAN

No area of land can be everything to everybody. The Society's Nature Centers Division has found that certain uses are compatible to an outdoor laboratory; others are not. If the Gateway Center is to become an outdoor laboratory, then the following compatible and non-compatible uses should be noted:

Compatible Uses

Land and water conservation practices
Nature and ecological studies
Organized, naturalist-led walks
Self-guided walks
Bird studies
Field crop demonstrations
Wildlife habitat improvements
Organized (group) outdoor education tours
Indoor and outdoor lectures
Nature painting, photography, sketching, writing
Educational day-long sessions for school, college and recreation groups, especially in the summer

Non-Compatible Uses

Picnicking
Collecting of specimens and materials

Trailer camping, overnight tent camping
Hunting and fishing
Field sports-ball sports
Rifle marksmanship
Horseback riding
Motor scooter use
Animal zoo (caged mammals and birds)
Indiscriminate lounging and romping through the area
(walking permitted only on established trails)
Bicycling

SUGGESTED IMPROVEMENTS

Certain land and water improvements and features, including educational facilities, are basic to a successful outdoor laboratory. However, only the more important of these are recommended in this report. A number of such features are shown on Map 2 on the next page. Each is described briefly and accompanied by a priority rating to effect a suggested order in development. Priorities are symbolized as follows:

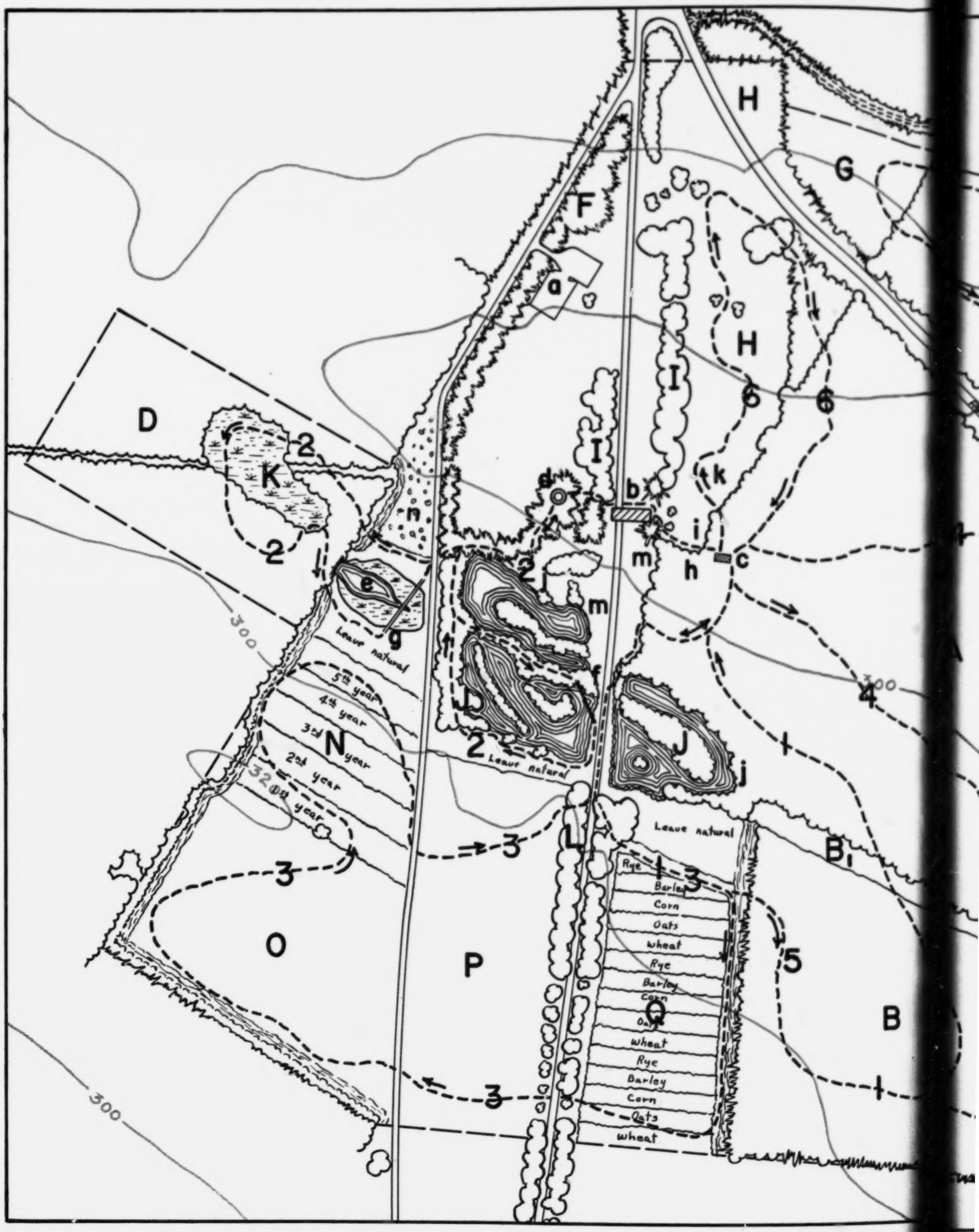
First priority: PR-1 (immediate development)

Second priority: PR-2 (secondary stage development)

Parking lot (PR-1). A graded lot for 20 cars will be needed near the entrance to the Gateway Center. Note suggested location and layout on Map 2.

Portable chemical toilets (PR-1). A minimum of four portable chemical toilet units will be needed with placement somewhere near the parking lot. There seems to be no other feasible solution to handling busloads of pupils who will be coming to the Gateway Center.

(Suggested Improvements continued on page 20)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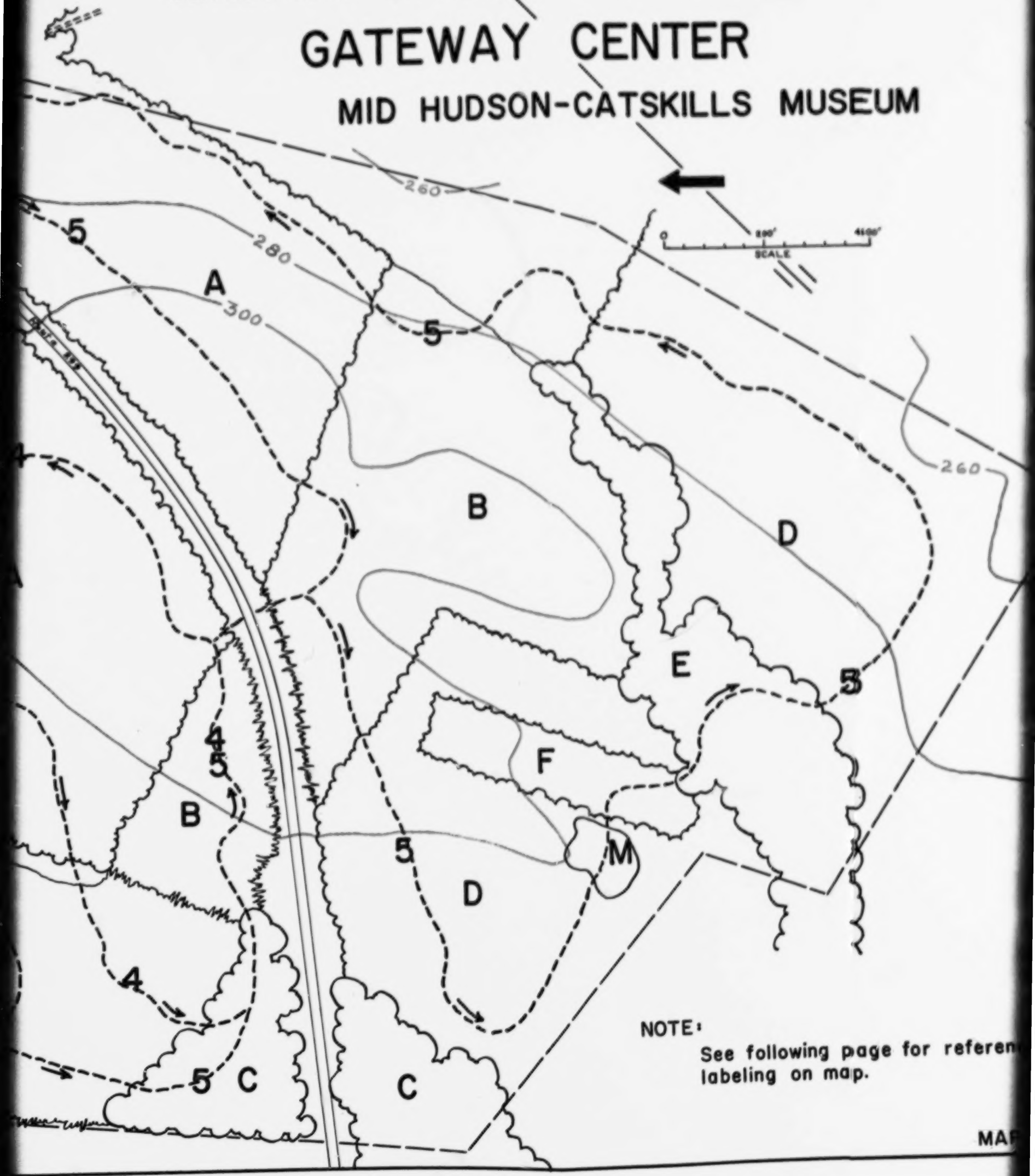
DEVELOPMENT AND PHYSICAL FEATURES MAP

GATEWAY CENTER

MID HUDSON-CATSKILLS MUSEUM



NOTE:

See following page for referen
labeling on map.

MA

References to Labeling on Map 2

Ground Cover

A. young oak-hickory
B. red cedar
C. swamp hardwoods
D. mixed hardwoods
E. mature oak-hickory
F. planted scotch pine
G. mixed oak-scotch pine
H. old field-natural reseeding
I. planted sugar maple
J. mixed shrub-hardwoods
K. old swamp-mixed shrub
L. planted pine oak
M. big-tooth aspen
N. plowed strips
O. mowed once a year
P. mowed several times a year
Q. field crops

Trails

1. nature
2. wetland
3. field
4. forest
5. hiking
6. succession

Other Features

a. parking lot
b. gateway
c. shelter
d. council ring
e. pond and marsh
f. elevated walkway
g. raised trail
h. log and stump
i. geology wall
j. photographic blind
k. weather station
l. bird feeder
m. herb garden

Outdoor shelter (PR-1). An outdoor shelter at least 20'x30' will be needed at the location shown on Map 2. This can be of pole construction with a woodchip floor and an adirondack-type roof line, and have three sides enclosed for protection against wind and rain.

Trail system (PR-1). A carefully planned and well constructed trail system is indispensable to the operation of the Gateway Center. The following trails are suggested and a proposed layout for each can be found on Map 2: nature, wetland, field, forest, hiking, and succession.

Where new heavy-use trails are put through dense growth of bushes, shrubs or young trees, it is desirable to clear the trail from 8 to as much as 15 feet wide. Such clearing not only encourages ferns, clovers, grasses and some flowering plants, but makes trail maintenance easier. Clearing should be 10 feet above the trail in order to allow for branches that hang down when wet from rain or laden with snow. Cut large trees only where it is impracticable to build around them. Brush and logs from the clearing process can be stacked into large piles at some distance from the trail to serve as wildlife shelters. All cutting should be done very close to the ground and all stumps and rocks should be cleared from the tread area. This includes small stones, snags and roots.

Shrubs and many trees may send up dense clusters of sprouts after the main stem has been cut. In such cases it seems wise to use chemical controls instead of allowing these sprouts to become dense clumps which get in the way and require further hand cutting. The fresh-cut stumps can be sprayed or generously brushed with a mixture of 2-4-5T ester, using one-half cupful of the ester to one gallon of kerosene.

Bulletin #4, "Trail Planning and Layout," published by the National Audubon Society is suggested as a guide for those who plan and construct the trail system for the Gateway Center.

Council Ring (PR-1). This is a trailside facility for orientation before a group begins a trail tour or a place to hold critiques after a field trip has been completed.

Elevated walkway (PR-1). A simple bridge across one corner of the pond as part of Trail #2 is recommended.

Emergency fire tool box (PR-1). A metal display box containing forest fire fighting tools set on four treated posts and placed along the forest resources trail loop or near the interpretive building, is a place where the story of forest fire prevention and control can be stressed. The tools can also be used for emergency purposes, and should include an Indian back-pack pump, 4 council fire rakes, long-handled shovel, regular rake, rattan broom, swatter and Swedish bow saw.

Farm crop demonstration (PR-1). It is suggested that the south field above the trail be divided into eight strips and planted so as to have a plot of each of the following crops for observation, comparison and study by visiting groups: wheat, oats, corn, hay, buckwheat, barley, rye and wildlife foods (a mixture of buckwheat, foxtail millet, sudangrass, soybean and cowpeas).

Weather station (PR-2). A small but officially approved U.S. Weather Bureau field station, equipped with a rain gauge, psychrometer, thermometer, aerometer and directional wind vane can be located near the interpretive building. Records of daily readings can be kept and periodically sent to the U.S. Weather Bureau, Department of Commerce, Washington, D.C.

Herb garden (PR-2). A plot of mints and seasoning herbs that can be grown in the locality is an interesting demonstration. A garden club may be willing to provide and maintain such a project.

Bee tree (PR-2). A bee tree is a fascinating trailside feature. If a wild bee tree cannot be found in a convenient location, a swarm of bees can be placed in the crevice of a hollow tree. The director should secure the technical assistance of a professional beekeeper for this feature.

Photographic and observation blind (PR-2). One or more blinds

can be constructed of plant materials or woven redwood panels and located in different habitats for wildlife study and photography. Locations should be selected by the director.

Super bird feeder (PR-2). A large bird-feeding station with a bird bath and dripping water should be located near the interpretive building, screened with shrubs in semi-circular fashion, yet visible from a nearby observation blind.

Tree Stump and mounted log display (PR-2). Where convenient along the trail, a tree stump with sloping cut can be made into a smoothed and waterproofed display. A log can be split, sanded and varnished to show rays, grain and wood texture.

Geology and fossil wall (PR-2). This is a short, low, stone wall exhibiting on top in cemented fashion a number (10 or 12) of the more important rocks, fossils and minerals of the area. It should be accompanied by a panel showing the origin, location and name of each specimen imbedded on the wall.

Improving food and cover conditions for wildlife (PR-2). An area such as "N" on Map #2 can be managed to attract such seed-eating birds as snow buntings, redpolls, goldfinches, tree sparrows, mourning doves and juncos. No planting is necessary. Lay the field out in five strips. Width is not too important but probably each strip should not be less than 10 feet nor greater than 30 feet wide. Each year plow a single strip in sequence, such as 1-3-5-2-4. By repeating the sequence after the fifth year, shrub invasions are halted and strips of mixed vegetation are continually available to birds.

Favorite bird foods are annuals such as bristlegrass, barnyard grass, panic grasses, lambsquarter and ragweed that spring up the first year. A mixture of perennial grasses, oxeye daisies, asters, goldenrods, blackeyed susans and others will cover the plowed areas by the third year. After several years of operation, the strips will make an excellent demonstration of plant succession.

Hedgerows are recommended for two fields. In the north field an "L"-shaped strip can be developed and in the south field

a strip can be developed between the crops and the woods. These hedgerows can be established by planting seedlings of desirable wildlife plants by hand or with a tree planter. An alternate way is by use of the "plow-perch" method; that is, in summer or early fall, plow a 10-foot strip where a hedgerow is desired. Set fence posts in a straight or staggered line at about 20-foot intervals down the center of the plowed strip. String wire or binder twine between the posts for perches. Fruit-eating birds will plant their choice foods, such as wild cherries, blackberries, dogwood, raspberries, elderberries and mulberries. These "plow-perch" plantings grow almost as fast as those produced from rooted stock.

Many additional suggestions for making habitat improvements for wildlife can be found in Appendix C.

Soil Profile (PR-2). A pit dug in the earth along a trail can show a typical soil profile in the area.

PROGRAM OFFERING

The crux of an outdoor education program is the laboratory use of the total environment in a community. As our citizens move away from the land and into urban developments, they lose sight of the concept that they are a part of a vast living system. When this happens air and water pollution, blighted areas, trash on the sidewalks, ugliness and decaying neighborhoods become commonplace in the urban sprawl. One approach to combat this trend is to have people renew their contacts with the land and to learn what is involved in maintaining a life-supporting environment. Perhaps Thoreau pointed to the heart of the problem when he wrote, "A town is saved, not more by the righteous men in it than by the woods and swamps that surround it."

The use of the outdoors has special significance to school children. The experiences of a child at an outdoor laboratory has an educational impact on him far greater than one would expect from such short periods of time. By combining outdoor learning experiences with the school curriculum, a degree of program continuity is attained which is matched in few other school situations.

In this context the offerings at an outdoor laboratory are an integral part of the school curriculum. The land becomes a laboratory where children may experiment and work with real objects, situations, demonstrations and ideas suited to them. It naturally follows, therefore, that an outdoor laboratory should operate under the overall aim of correlating the outdoor activities with the indoor classroom curriculum.

The setting that an outdoor laboratory offers for learning represents the unity of the environment of which man is an integral part. The outdoors provides a laboratory situation for many of the traditional school subjects. The very nature of this setting, however, makes it particularly suited to explorations and learnings in social science (democratic living and local history), natural science as well as the conservation of natural resources.

The following is a partial list of activities which

school classes can enjoy in the outdoors and which will enrich the curriculums in the schools.

Science

1. Astronomy--observation through telescope correlated with use of sky charts
2. Geology
3. Plant study
4. Animal study
5. Ecology--soil-water-plant-animal interdependence
6. Weather--factors, cloud formation, forecasts
7. Soil as the living mantle of the earth
8. Natural succession
9. Life history studies

Conservation

1. Wise use of natural resources--water, forests, soil, air, natural beauty, wildlife
2. Animal habitats
3. Use of bird and other wildlife studies for recreation
4. Erosion problems--control projects on site and in the community
5. Water supply and sewage disposal

Mathematics

1. Forest--finding height of tree, figuring board feet in

a tree, volume of a cord of wood, length of chain rod, size of acre (stake out an acre on a grassy field)

2. Compass orientation and map making

Language Arts

1. Creative writing--poems, stories, skits
2. Oral and written reports on the outdoors

Social Studies

1. Organizing and cooperating in groups--democracy in action
2. History of region
3. Past and present uses of region's resources

Art

1. Sketching and drawing--pencil and charcoal
2. Painting
3. Ceramics
4. Woodcrafts--small wood carvings, wood burning
5. Photography
6. Creative expression through design and model

Music

1. Creative music
2. Music in nature--songs of birds and other forms of wildlife, sounds and rhythm of wind-rain-thunder.

Appendix A, "Suggested Principles of Conservation to be Stressed and Recommended Methods of Illustration," lists a number of concepts of conservation and ways of teaching them. In Appendix B a number of "tips" are given for teaching in the outdoors.

PART III

APPENDICES

A. Suggested Principles of Conservation to be Stressed and Recommended Methods of Illustration

B. Tips for Field Trip Fun

C. Habitat Improvement for Wildlife

APPENDIX A

SUGGESTED PRINCIPLES OF CONSERVATION TO BE STRESSED AND RECOMMENDED METHODS OF ILLUSTRATION

The Nature Centers Division of the National Audubon Society strongly recommends that full cognizance be given to the "what, whys and wherefores" of the conservation education program at the nature center. It is not enough to have all types of educational features on display and in operation and not have a clear understanding of what it is that the nature center wishes to portray and interpret. Specific information must be related to principles and concepts; otherwise, one may leave the center with a pocketful of information with no thread to tie it all together. The following principles and their supporting ideas on interpretation and illustration are worth keeping in mind.

GENERAL CONSERVATION PRINCIPLES

1. Conservation denotes more than wise natural resource use. It includes the practice of wise resources management and a way of life. In other words, it embraces a philosophy of living as well as land practice.

2. Man gives meaning and importance to certain natural resources, but he is also the greatest despoiler of all. By good or bad practices or actions, man can slow down or hasten resource use and exploitation; he can also promote rehabilitation.

3. The basic natural resources are soil, water, forests and other plant life, wildlife and natural organisms and minerals. Air and sunlight are also resources, as are scenic landscapes and other esthetic attractions.

4. All resources are related and interdependent. Man cannot survive without them.

5. The strength of the mind, body and spirit is rooted deep in nature and the land. For America to remain a strong and vigorous nation, it must have a bedrock of ample natural resources.

Illustrations

1. Panel exhibits, encased, showing principles of conservation as outlined. Size: 5'x10'x1', glass front.

2. "Pathway to Conservation" exhibit, in interpretive building. Panel display in orientation room, illustrating how conservation becomes a way of life, e.g., knowledge of natural resources leads to understanding--interest--attitudes--appreciation--respect--reverence--a will to protect and use wisely--actual conservation behavior and action. (Get copy of Nature Centers Division Information-Education Bulletin #2, Planning a Nature Center, for more details.)

3. Interrelationship exhibit, in interpretive building. PaneI glass exhibit shows interrelationship of man with plants, animals, soil, water, minerals, air and sunlight.

4. Resources exhibit, in interpretive building. A. What is a resource? B. What is a natural resource?

5. Interdependence exhibit, in interpretive building. Shows habitat variety and interdependence of plants, animals, soil and water.

6. Results of poor conservation practices exhibit. Illustrate soil erosion, water pollution, etc.

SOIL RESOURCES PRINCIPLES

1. Soil is parent inorganic material, plus organic matter in various stages of decomposition.

2. Soils develop slowly over the centuries. Once destroyed they are difficult to rebuild or replace. (It is estimated that it takes nature, under favorable conditions, some 500 years to produce one inch of topsoil.)

3. Soil fertility depends on several factors: type of soil, texture, organic matter, chemical content, etc.

4. Productive soils need organic matter.

5. Good soils are basic to a strong agricultural economy.

6. Erosion is soil waste. It can and should be stopped wherever possible.

7. Planned land use promotes soil conservation.

Illustrations

1. Display a compartment box showing how soils form.

2. Soil profile exhibit showing different layers of soil and their composition.

3. "Soil is Alive" exhibit. Fenced-off square yard of soil shows variety of plant and animal life on one square yard plot. Plants can be identified by using a cross bar, with labels attached, above the plot, with strings leading from each label to a peg beside the plant identified and described.

   An indoor exhibit might consist of preserved insect and plant specimens taken from a square yard of soil. A chart can be used for descriptive purposes.

4. Soil samples. Glass or plastic cylinders showing types of soils in the state. The samples might be placed beside a map showing the area where each type of soil is found in the state.

5. Types of soil erosion. Exhibit showing gulleys, wind, water and sheet erosion.

6. Demonstration of soil conservation. Set aside one or two acres on a ridge. Denude half the area of trees, grass and other plants. Leave remaining area intact. After some erosion takes place on the unprotected area, a dramatic comparison can be made.

7. Demonstration showing how a soil-testing kit is used.

8. Visit nearby farms to observe soil and water conservation practices that are employed on the land, or the lack of it.

WATER RESOURCES PRINCIPLES

1. Water is basic to all life.

2. Pure water is getting to be a scarce commodity.

3. Polluted water is a menace to animals and man. Only vigorous pollution abatement can clean up our present water supplies.

4. All water comes from the sea and eventually returns to the sea.

5. Water is a source of hydro-electric power.

6. Water is a moving force, causing floods, landslides, erosion, siltation.

7. Water is a great recreational resource.

8. Water should not be feared but respected.

9. There is enough water for our present needs, but it must be harnessed, stored, kept clean and re-used wherever possible.

Illustrations

1. Exhibit showing types of water pollution (in glass cylinders).

2. Water uses display showing major water uses in the state (recreational, home and industrial).

3. Exhibit showing water cycle.

4. Display showing effects of water erosion.

5. Chart showing how many gallons of pure water an average family uses in a year, how many gallons it takes to grow an acre of corn, etc.

6. Chart showing percentage of water in a human, in an apple, in a head of lettuce, etc.

7. Relief map of the state showing major rivers, impoundments and watersheds.

FOREST RESOURCES PRINCIPLES

1. The largest and oldest living things in the world are trees.

2. A tree is a unique plant.

3. A tree structurally is a replenishable resource.

4. A tree grows outward and terminally upward.

5. A forest is a plant and animal community dominated by trees.

6. A tree is distinguished from a shrub in that it has one trunk or stem and normally grows to be thirty or more feet tall.

7. Forestry is the science of forest management.

8. Trees give us many products.

9. Forest cover on hills and mountains make a good watershed. They hold water and prevent rapid run-off.

10. Forests are a renewable natural resource. Careful timber harvesting keeps the forests healthy.

11. The greatest enemies of the forests are insects, disease and fire.

12. Trees affect climate.

13. Forests are also the home of fish and wildlife and provide places of esthetic beauty for man.

Illustrations

1. Multi-purpose observation platform in the woods.

2. Forest fire-fighting tools exhibit.

3. Forest succession and natural regeneration area. Clear an area and let nature take charge for a few years. Identify various stages of plant succession.

4. Timber harvest area of approximately five acres demonstrating types of silvicultural practices.

5. Small forest nursery to show seeding and forest nursery practice.

6. How a tree grows exhibit, showing water transpiration, root pressure, growth, etc.

7. Pruning and thining area to show growth of trees (a project for youngsters).

8. Evergreen tree plantation (ten acres) area should be selected by a district forester and managed by teenagers.

9. Cross section of tree stump. A sloping cut on top of tree stump is made smooth and waterproofed. Markers tell age of tree by annual rings and relate historic events which took place during different age periods. Split section of log placed nearby shows that wood grain is caused by annual rings.

10. Forestry instruments and tools display. Exhibit features tree culipers, log rule, increment borer, abney hand level, tree planting tools, etc.

11. Shelter belt demonstration. Planting of willows on a strip of wetland and pines on dry land to demonstrate shelter belt protection on both wet and dry sites.

12. Cordwood display. This would be an actual cord of wood stacked and labeled along a trail.

FISH AND WILDLIFE RESOURCES PRINCIPLES

1. Wildlife denotes wild vertebrates.

2. All wild animals need water, food, cover and protection to survive.

3. Predation is a natural phenomenon.

4. Plants and animals are integral parts of small or large food chains.

5. Wildlife is a valuable renewable natural resource.

6. Wildlife responds quickly to suitable conditions of water, food and plant cover.

7. Diversity of plant cover is generally conducive to wild animal life.

8. Wild animals should not be feared but respected.

9. Captivity promotes domesticity. Wildlife should be left wild wherever possible.

10. Game animals, birds and fish, when properly managed, can provide man with wholesome sports of hunting and fishing.

11. Observance of game and fish laws and other wildlife regulations are basic to wildlife conservation.

Illustrations

1. Have a wildlife trail lead past bird houses, den trees, hollow logs, wildlife shelters, feeders and food plots.

2. Designate several acres as a special bird sanctuary and construct bird houses, bird baths and feeders for the area.

3. Designate a fish-for-fun area.

4. Provide a reptile island. This can be a natural, small island surrounded by a water moat and curved cement walls (natural as possible), or overhanging rocks cemented together, accommodating native snakes and turtles.

5. Arrange an animal-baited area. This is a useful device for luring animals into an open area where they can be observed or where they can leave signs they were about.

6. Provide an aquarium. Small fresh water aquariums, displaying all native fish and amphibia, can be extremely educational.

7. Make an animal track walk. Pave a walkway near the interpretive building showing all types of wild animal tracks imbedded in cement slabs. Numbers identify animals in nearby display case.

8. Chamber of skulls. A display area in the interpretive building showing skulls of all native mammals, birds and reptiles, including story of how identification is made through the scientific study of skulls.

9. Water hole and photo blind. A baited area for use of animals and a nearby photographic blind.

10. Chart illustrating food chain.

11. Food for wildlife. Locate sites for food patches and border plantings and plot them on a master plan map. Engage teenagers to do the actual work.

GEOLOGY AND MINERAL RESOURCES PRINCIPLES

1. A mineral is an inorganic substance occurring naturally in the earth and having distinctive physical and chemical properties and a composition that can be expressed in a chemical formula.

2. A rock differs from a mineral in that it is merely a fragment of the earth's inorganic crust and seldom has consistent physical and chemical properties. A rock, therefore, is a grouping or a regrouping of one or more minerals.

3. Coal is not a mineral but an organic substance, commonly referred to as a fossil fuel.

4. A knowledge of rocks and minerals and geology gives us a picture of our prehistoric and historic past.

5. Minerals and fossil fuels occur in limited quantities. Conservation entails careful and restricted methods of extraction and use. Once used up, these materials are gone forever.

6. Rocks are grouped into three main categories: igneous, metamorphic and sedimentary.

Illustrations

1. Geology wall. A low stone wall with various rocks and minerals cemented on top to show local occurrences. A nearby trailside display identifies specimens.

2. Display showing how sedimentary, igneous and metamorphic rocks are formed.

3. Display showing how glaciers and the ice ages have changed the topography of the land.

4. Chart depicting the many different products made from rocks and minerals.

5. Exhibits showing how mountains, valleys, lakes, meadows and marshes are formed.

OTHER EDUCATIONAL FACILITIES AND ILLUSTRATIONS

1. Insect display. Mounted specimens of species found in the local area with charts depicting their life histories.
2. Plantings of local soil erosion control grasses.
3. Elevated walkway. A footbridge constructed on driven poles can carry many people over a marsh or lagoon for observation purposes without destruction to the habitat.
4. Botany pool. A 6'x15' pool can be cleaned out in a wet area which would attract certain aquatic plants while others are planted for special studies. The plants might include water lilies, cattails, pickerel weeds, arrow leaf and rushes, with liverworts and other water-loving plants along the edge of the pool.
5. Weather station. A complete weather station, in conjunction with the study of meteorology, can be an extremely useful teaching tool. The United States Weather Bureau has established cooperative weather stations in many parts of the country with little or no cost to the individuals or groups that assume responsibility for maintaining them. It is possible that the nature center might qualify for a similar weather station.

6. Wilderness trail. Unlabeled trail into primitive natural area for esthetic and spiritual walks.
7. "Five Senses" trail for the physically handicapped. A short, black-topped trail especially designed for wheelchair patients, the blind and other physically handicapped people.
8. Beehive. Traditional boxed indoor beehive with tube running outdoors to permit ingress and egress of honey bees. Placed in the interpretive building, with display exhibit telling the story of the bee.
9. Grafting demonstrations. Illustrates how trees can be propagated and cross-bred to produce new species.
10. Herb garden. Consists of food seasoning and medicinal plants. An herb garden can be a useful teaching aid for a home economics class.
11. Council ring. A small assembly area composed of logs where groups can meet outdoors for an orientation before the field trip.
12. Observation platform. The platform can be used during the day for bird observations and at night as a place to mount a telescope for the study of the night sky.
13. Garden plots. Garden experiences teach youngsters basic skills and the knowledge necessary for planting,

caring and propagation of indoor and outdoor plants.

14. Exhibits which interpret specific features in the state. These might include marshes, swamps, ponds, glacial moraines, kames, deltas, etc.

15. Science laboratory. A room equipped with microscopes, soil and mineral testing equipment and such material as is needed for engaging in study projects which cannot be conveniently carried out in the field. A laboratory would be a boon to science-talented youngsters who might desire to carry on their particular science projects after school hours.

16. Science library. Contains reference and general books, field guides, magazines and other written material pertaining to the physical and biological sciences and conservation not available in some schools.

APPENDIX B

TIPS FOR FIELD TRIP FUN

1. Use a mirror to spotlight items difficult for the group to locate.

2. Notice where an action changed the normal life for some plant, animal. See if you can guess what life was involved, time elapsed, effect.

3. Draw the limb structure of two trees.

4. Adopt a plant. Determine best environment, most frequent guests.

5. Pencil print the leaves still on the plant for identification, games. Note variety of margins, venation, shapes, arrangements, etc.

6. Count all objects in "a world at your feet" about 1 yard square.

7. How many leaf shapes can you count within your range of vision?

8. From the feel of a leaf determine what type climate it is best fitted for. Memorize it by odor, if any.

9. Look on cuffs, socks, shoes for hitchhiking seeds (at the end of hike).

10. By scattering colored crackers and assorted foods observe at an ant's hill their speed, choice, problems in getting chosen foods home.

11. Place a light flat surface, cloth or paper, under a bush. Strike the limb and check the insects jarred loose. Magnifying glass useful.

12. Use a magnifying glass to compare two flowers or any two similar objects.

13. Look for and draw bird, animal or insect tracks on the trail.

14. In two different habitats list all the sounds you hear. Sources.

15. Place weather ribbons in varied places. What effect does moisture or lack of it have on inhabitants?

16. Place inexpensive thermometers in various places. Check life found in such "little climates" as old gopher hole, under debris, or bush.

17. On a silhouette pattern of a bird make notes of markings, color for identification, or craft record of birds observed.

18. Demonstrate your impression of a bird's flight by arms, fingers.

19. Draw a bird's song by using dashes, dots and lines. Show changes in pitch by making patterns go up or down.

20. Compare the markings and color of birds, insects, animals with their immediate surroundings.

21. Put rocks in a can with lid. Each person shake 100 times. Check the results. Compare with state of soil near the group.

22. Summarize your field trip by making "food chains" of the plants and animals observed; land, grass, gopher, hawk, etc. Try not to repeat.

Compiled at the Audubon Center of Southern California

APPENDIX C

HABITAT IMPROVEMENTS FOR WILDLIFE

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PART 1. THE ABC'S OF WILDLIFE MANAGEMENT

Production of wildlife is governed by natural laws, as distinguished from the man-made laws. Natural laws are fixed and unchangeable, enforced by such basic facts as birth and death and the need of living things for food, water and shelter. We cannot re-make natural laws to suit ourselves; all we can do is to understand them and work with them. To work against them brings certain failure.

Understanding the laws of nature requires study and thinking. To outdoor enthusiasts and others interested in wild creatures, however, it is an easy and pleasant study, as simple and logical as everyday arithmetic. As in arithmetic we can start with something we know and go on from there.

One of the first simple things we know is that there is wildlife almost everywhere. It is present naturally. We did not "produce" or make it. The next fact is that wildlife, like all life, must eat, drink and find shelter in order to live. It must find a place to raise young. Wherever you find any species of wildlife, you know it is finding the kind of food, water and home that it needs. Otherwise, it wouldn't be there.

Only the wild creatures that find enough of the right kind of food, cover and water will live. The rest must either starve because they cannot eat, be killed because they cannot hide, or they will die because they cannot raise enough young to replace their losses. In a sense, these are expressions of natural laws.

These natural laws are the basis for one of the important principles of wildlife management. This principle is called carrying capacity. Carrying capacity is the number of quail, rabbits or other wildlife which any piece of land will support or "carry" at one time. The amount and quality of the food, cover and water which determine carrying capacity are, in turn, determined by (1) the kind of soil and its fertility and (2) the way the land is used.

Fertility is the richness of the soil--the kinds and amounts of food elements, like iron and calcium and nitrogen, contained in the soil in forms that can be used, first by plants and in turn by animals. If there isn't enough lime or phosphorus in the soil to grow bones and teeth and to make good blood, the wild

animals that live there will be few and unhealthy. The same is true of domestic animals. If there aren't enough nutrients forthcoming from the soil, the animals will be diseased and will fail to bear enough healthy young.

The best land use is that which produces the greatest benefit for people while conserving soil, water, minerals, and native plant and animal life. Some land may be used chiefly for grain while other land, which cannot be cultivated without erosion, must be kept in pasture or meadow. Still other land, unsuited either for cultivation or grazing, will grow valuable timber. In many parts of the country the pattern of land use must be greatly varied: a tract here in cultivation, a strip there in grass, a hillside or waterway in trees. Wildlife is a valuable by-product. We Americans have made many mistakes in land use. We have overcropped our fields, overgrazed our pasture, overcut our timber, wasted our soil, silted our streams, destroyed the homes of wildlife.

Fortunately, soil fertility can be built up or conserved, and land use can be changed for a better balance with nature. Doing this is profitable to the farmer and beneficial to his domestic stock, and it helps wildlife by increasing the carrying capacity of the land for it. Therefore, carrying capacity for wildlife can be increased by the same methods which help the farmer improve his land and crops. Good wildlife management is just good farming. The same principles apply on small parcels of land--the back "forty," a small woodlot, a limited natural area, a piece of unspoiled land, or even a suburban lot.

The fact that carrying capacity can be increased wouldn't mean much if it weren't for another natural law. This law is the power of wild creatures to produce young in numbers far greater than needed to keep up the population level, if all of them lived. One quail hen will lay an average of 14 eggs. If all should hatch and the young should live and reproduce at the same rate for five years, the total number of quail resulting from this one bird would be 65,536!

To increase the number of young reared successfully to maturity, the landowner must improve the carrying capacity of the range during the nesting and rearing season. Specifically, this means increasing the amounts and quality of food, cover and water which, according to the natural laws, determine how many young quail live and how many will die.

The wildlife conservation lesson in all this is plain. People cannot produce wildlife; only nature can do that. We can help, however, by understanding and working with nature and her laws. We can increase wildlife by helping nature increase the carrying capacity: by restoring soil fertility and by wise farming and forestry practices which will provide more and better food, cover and water for wildlife, and at the same time provide better living conditions for people.

The National Audubon Society, in cooperation with local, state and federal wildlife agencies and private organizations, clubs and individuals, encourages all landowners to help wildlife by providing mammals and birds with additional supplies of natural wildlife food plants, by planting wildlife borders and sowing food patches. It is only through such a program that permanent improvements can be made in wildlife habitat. More food, more water, more cover means more wildlife for Americans to enjoy. Nature, through her amazing power of reproduction, will stock the new wildlife areas as fast as we can provide them.

In summary, the most basic of modern wildlife management practices--and the one that comes nearest to being a "cure-all" for dwindling numbers of wild birds and mammals--is habitat maintenance and improvement. Wildlife habitat is a combination of water, food, cover and living space. Improvement in quality is the principal means by which wildlife habitat can be increased in any area.

Habitat improvements are not only important educationally for people who come to a managed area to study or work with natural resources. For students there is the opportunity for direct, firsthand experience by working with habitat improvement measures. Also, through such activities as making a census of mammals or birds in an area, studying the variety of food and cover present, checking for available water supplies, analyzing tree growth and making soil tests, students discover some of the problems of the living world. Significantly, too, some solutions to problems are sometimes uncovered.

It is evident that any practice which benefits one species of wildlife will usually benefit a few other forms. Or to put the matter in another way, no single form of wildlife stands alone in the natural world.

PART 2. SONGBIRDS AND NON-GAME BIRDS

Management Practices

1. Protect marshes, swamps, woodlands and streambanks from fire.
2. Save, establish and maintain shrubby fencerows, hedgerows and thickets.
3. Construct small ponds and other wet areas.
4. Make clearings in mature forests.
5. Provide food patches.
6. Allow some dead trees to stand.

Hedgerows

The low, woody vegetation of hedgerows is the desired habitat of many songbirds. Bush honeysuckle, wild plum, autumn olive, highbush cranberry or any of several other shrubs make effective hedgerows along field borders, gullies or ponds. These plants attract the catbird, cardinal, mockingbird, cedar waxwing, brown thrasher, indigo bunting and others.

Probably the most popular hedge or living fence is the closely-spaced plantings of the multiflora rose. It provides travel lanes for many kinds of wildlife and is used as homesites by birds, small mammals and predaceous insects that help control insect pests. Mockingbirds, cardinals, towhees and indigo buntings utilize the rose fences. Such plantings are an excellent means of encouraging the insectivorous praying mantis, the egg cases of which are a common sight in rose hedges.

Hedgerows can be established by planting seedlings of desirable wildlife plants by hand or with a tree planter. An alternate way is by use of the "plow-perch" method. That is, in summer or early fall, plow a 10-foot strip where a hedgerow is desired. Set fence posts in a straight or staggered line at about 20-foot intervals down the center of the plowed strip. String

wire or binder twine between them for perches. Fruit-eating birds will plant their choice foods, such as wild cherries, blackberries, dogwood, raspberries, elderberries and mulberries. These "plow-perch" plantings grow almost as fast as those produced from rooted stock.

Fencerows

When allowed to develop, fencerows grow into shrubby borders and can be maintained as such by cutting down tall trees as they appear. The idea is to have a thick, bushy row of small trees and shrubs. Shrub borders harbor many beneficial insects, such as the ladybird beetle and praying mantis, and small mammals. Shrubby fencerows are used by such birds as the thrasher, cardinal, goldfinch, red-eyed vireo, mockingbird and chipping sparrow.

Roadsides and streambanks are much used by the birds listed for hedgerows. Ground nesters use them if they are in grass, whereas the tree and shrub nesters occupy them if woody cover is dominant. Mowing is one way to control unwanted plants which may grow along fencerows.

Mature Woodlands

Tall trees are nesting places for the great horned owl, red-tailed hawk, Baltimore oriole, scarlet tanager and others. Dead trees with hollow trunks invite flickers, redheaded woodpeckers, sapsuckers, bluebirds, house wrens and screech owls. To provide for these species, leave dead trees standing in the woodland or kill two or three tall, unwanted trees per acre. Killing is best done by "ringing" or girdling the trunk, that is, cutting through the bark in a strip two or three inches wide around the tree at breast height and one to two inches deep into the sapwood. Grasses and shrubs will appear in an area formerly shaded by a tree and will attract birds other than the kinds noted above.

Woodland Clearings

Dense mature woodlands seldom harbor many small birds. To encourage more use by wildlife, it is necessary to make openings in established timber stands to provide a greater variety of food and cover plants, better nesting sites and better feeding places for young broods.

One method to open a forest is to clear-cut the timber from one-half to two-acre plots. Open areas can be of any shape, but open strips 30 to 60 feet wide and generally running east and west are best. Clear-cutting is not necessary in timber stands open enough to permit the growth of blackberries, blueberries, grasses and similar plants. When plants of this kind are shaded out of previously made openings, it is time to cut new openings.

Another method to provide openings in a timber stand is to select trees, such as apple trees (gone wild or in an old orchard), wild cherry, hackberry, oak or hickory, and apply the orchardist's plan for producing more fruit. Measure the diameter of the tree in inches at 4½ feet above ground, multiply the diameter by 3, substitute feet for inches. This gives the length of each side of a square from which all trees are to be removed except the fruit tree to be favored. Example: the selected tree is 10 inches in diameter at 4½ feet above ground. Multiply 10x3 = 30 inches. Substitute feet for inches. This makes the length of each side of the square 30 feet. Center the tree in this square and remove all other trees. A surprising number of shrubs, grasses and new birds will appear.

Volunteer Food Patches

A small field can be managed to attract such seed-eating birds as snow buntings, redpolls, goldfinches, tree sparrows, mourning doves and juncos. No planting is necessary. Lay the field out in five strips. Width is not too important but probably each strip should not be less than 10 or greater than 30 feet wide. Each year plow a single strip in sequence, such as 1-3-5-2-4 or 2-4-1-3-5. By repeating the sequence after the fifth year, shrub invasions are halted and strips of mixed vegetation are continually available to the birds. Favorite bird foods are annuals such as bristlegrass, barnyard grass, panic grasses, lambsquarter and ragweed that spring up the first year. A mixture of perennial grasses, oxeye daisies, asters, goldenrods, blackeyed susans and others cover the plowed areas by the third year.

Planted Food Patches

Food patches planted for songbirds will attract many seed-eaters. The size may range from 100 to 2,000 square feet or

more. Pure stands of corn, wheat, sorghum, millet or sunflowers produce the most food, but a mixture of these attracts a greater variety of birds. The bristlegrasses and ragweeds which accompany tilling of land are nutritious bird foods. All cultivation should be done on the contour when needed to avoid soil erosion. Long patches are preferred to square ones. There should be maximum sunlight and the soil well prepared and fertilized. Check the planting guide and the suggested food patch mixtures near the end of this appendix.

Wetlands

Many kinds of birds, from geese to tiny marsh wrens, are attracted to wetlands. The kinds and numbers drawn to the site depend on the size and location of the wet area, its degree of wetness and the plant and other animal life present. There are several kinds of wetlands:

1. Ponds. A dam constructed across a drainageway offers the best means of creating a wetland habitat. Ponds so created attract redwings, mourning doves, snipes, killdeers, herons and a number of other birds.

2. Water holes. These are constructed by digging pits to provide at least 200 square feet of surface area in land having a high water table (one foot or less below the ground surface) or in relatively flat drainageways where runoff will keep the pits filled with water. The holes should be four to six feet deep.

3. Marshes. Marshes support a myriad of plant and animal life. A marsh can be built on an open area of fairly flat land where soils are tight enough to hold water or the water supply is sufficient to compensate for limited seepage. The construction of a dam or dike is usually necessary. In the simple marsh, water will range in depth from one inch to two feet or more. A more elaborate marsh will have a larger water area and may have a depth of several feet at one end with most of the remainder covered by one or more inches of water.

   Vegetation may grow so dense as to eliminate all open water in a shallow marsh. It is important to have

some open-water areas scattered over a marsh. These can be created during the early construction stage by digging pits to provide minimum-sized water areas of 200 square feet from four to six feet deep. One or more such areas per acre of marsh are desirable. The spoil should be piled where there is no chance of its sliding back into the excavation.

Native marsh plants will quickly invade a new wet area; thus, planting is unnecessary. Circling the marsh with a row or clumps of selected shrubs adds to its beauty and usefulness. The plants should be set at least 50 feet from the water's edge.

A greater degree of management is possible if a water-level control device is installed in the dam. By fluctuating the water level an owner can reduce unwanted vegetation and encourage more desirable plants.

Tree and Shrub Plantings

Trees and shrubs provide cover, nesting sites and food for many birds. The pine family rates high in food and cover value with songbirds throughout the country. The dogwoods and viburnums are of great value to birds since about 90 different species eat their berries. If you can plant but one tree for the birds, make it a mulberry. The birds relish its berries, preferring them to such soft fruits as domestic cherries.

PART 3. COTTONTAIL RABBIT

Management Practices

1. Establish or maintain woody cover in hedgerows and fencerows. "Living brushpiles," small thicket-like plantings of multiflora rose, are ideal.

2. Pile brush in woodland borders.

3. Maintain cattail-covered marshes and sloughs for winter cover.

4. Establish and maintain grass or grass-legume stands on roadbanks and field borders. White clover with a suitable grass makes choice rabbit food.

Brushpiles

Locate brushpiles near the edge of a woods, field or marsh. Make them six feet high and 25 to 30 feet across so that a dog cannot burrow through or a person kick them over. Crisscross a few large logs or limbs for a foundation, or pile them over a stump to keep the cuttings from rotting down too quickly. Lay on slash generously and put some heavy pieces over the top so that wind will not blow the brushpile apart. Several animals, including rabbits, will use brushpiles for cover. By the time a brushpile rots, it will be replaced by a tangle of vines, shrubs and brambles--"a living brushpile."

Grass

Grass is a basic food provider for many species of wildlife, including rabbits, but it requires sunlight for growth. With this in mind it is necessary to carry out selective cutting and thinning of trees along roads, wood edges and field edges so that grass can take hold. Special attention should be given to seeding areas with grasses that thrive in partial or nearly complete shade. Red fescue, redtop, orchard grass, bluegrass and bristlegrass are some good and widely-used examples.

Special Food Patch

A plot of oats seeded with one of the following mixtures makes a good food and cover area for rabbits:

(Tables on next page)

Mixture #1 for one acre	lbs.
Orchard grass	2
Redtop	2
Red clover	2
Timothy	4
Alsike clover	1
Total.....	11

Mixture #2 for one acre	lbs.
Sweet clover (yellow or white)	1
Timothy	4
Alsike clover	2
Orchard grass	2
Redtop	2
Red clover	2
Total.....	13

Plow in early spring when the soil is workable and not too wet; lime, if needed; harrow and seed one bushel of oats per acre with one of the above mixtures, using sufficient fertilizer. If it is necessary to plow in the late summer or fall, winter wheat may be planted. Then seed the following spring to the proper grass-clover mixture or to clover.

The oats or wheat should be left standing in the field, thus providing food for all forms of wildlife that eat seeds. The seeding of clovers and grass will not only furnish food but also nesting cover.

It is recommended that a strip at least 15 feet wide be mowed along the edges of these clover-grass strips each year. Mow after the nesting season is over to produce succulent green growth.

Hairy vetch planted in the fall at the rate of 30 pounds per acre with one bushel of rye provides food that will attract cottontail rabbits from a considerable distance. Small plantings of turnip, mustard, kale and collards also make excellent winter "green patches" for rabbits.

PART 4. GRAY SQUIRREL AND RELATED SPECIES

Management Practices

1. Control fire in woods.

2. Manage forests according to accepted forest management principles; practice selective cutting; leave 2-3 good den trees per acre.

3. Favor choice, high-yielding, food-producing trees.

Nests

Squirrel nests are of two types: den tree nests and leaf nests. Den tree nests are the more important, affording the best protection throughout the year. There are two types of dens: those used for reproduction, shelter or escape, and those used for escape only. The latter consists of tree cavities that are too deep or shallow, or have entrances that are too large or damp. A depth of 2-3 feet from the den entrance is preferred. Ideally a den entrance should not be over 3½ inches in diameter. The following are general recommendations for selecting squirrel den trees that are to be saved from a timber cutting operation:

1. Select trees that provide food and have durable heartwood, e.g., white oak, black walnut, hickory, chestnut oak, red gum, black gum, maple or basswood.

2. Select a live tree at least 15 inches in diameter and with the den entrance at least 20 feet from the ground.

3. Select trees that are being used by squirrels.

4. Select den trees that are well distributed throughout the area. Good den trees are not always abundant in the more extensive forests. Where den trees are not found, nesting boxes should be provided.

Leaf nests are built in almost any species or size of tree and no special management measures are needed.

Food and Cover

Staple diet consists mostly of nuts and acorns and (in the case of fox squirrel) corn. Favored foods are hickory nuts, acorns, walnuts, butternuts, beechnuts, pine seeds, maple seeds and hazelnuts. Squirrels generally prefer hickory nuts over acorns. Seeds and buds of maple, tulip poplar and osageorange are also utilized.

Trees in the woodland border or around woodland openings are generally better food producers because they receive more sunlight and moisture. In summer and fall, fruits such as blueberry, black gum, blackberry, dogwood apple, wild grape and wild cherry aid in supplying food for squirrels.

PART 5. DUCKS, GEESE AND SWAN

Management Practices

1. Maintain, improve and increase wetland areas.
2. Control depth of water in pond areas.
3. Provide nesting sites.
4. Keep water areas open in winter.
5. Control excess vegetation in and around ponds.
6. Provide grazing areas for geese.
7. Provide loafing and nesting islands.
8. Control snapping turtles.
9. Increase size of sanctuary by agreement or lease from adjacent land owners.

Wetland Areas

Maintain and improve existing wetland areas and establish new ones. Reclaim former pond areas where periodic receding of water levels have encouraged overgrowth of shrub and emergent plant life. Restoration of these areas consists of removing surface sod and brush accumulation. Usually this material can be used to build island areas or "loafing sites" around remaining tree or shrub growth.

Additional peat, clay or gravel accumulation can be removed from the site. Shallow flooding of these areas provides much productive acreage. The removal of the sod alone may release good stands of duck potato and other excellent duck and wildfowl seeds and tubers that have been lying dormant.

Water-Level Control Devices

Build water control structures at outlets of marshes and low areas which have reliable water supplies. Regulate water levels to enhance the production of natural food plants and to encourage a desired ratio of cover to open water.

Construct "stone fords" in creeks and small streams to impede flow of water and thus create small impounded areas. This helps to stabilize water levels, especially during the nesting period. Gradual flooding of areas during late summer, when food plants are completing their growth, provides additional shallow feeding areas.

Used culverts from county road systems can be used very effectively to control small water-holding areas. A cement seep collar helps prevent washing-out and also doubles as a water-level control structure.

Draw down pond water level during mid- to late June, and allow shoal areas to dry for a few days. Disc or rototill exposed edges adjacent to grazing areas. Broadcast a seed mixture of smartweed, millet and buckwheat. As soon as shoots start to form seeds, allow water to rise slowly behind the growth to provide support for the fruiting heads. Such planted areas supplement the natural food production.

Fall and spring runoff ponds created by low dikes in hay fields and newly-seeded grain fields are used in several parts of the country. These areas attract wildfowl and shorebirds during fall and spring migrations. The addition of smartweed at planting time makes them even more attractive as waterfowl feeding areas.

Nesting Sites

In areas where intensive duck nesting is desired, hedges of nesting cover radiating from ponds are planted to multiply the number of territories available for nesting ducks and geese. Low-spreading shrubs and vines, such as multiflora rose, autumn olive, pfitzer juniper and honeysuckle are the most effective species to use.

Open Water in Wintertime

High-pressure water jets are often used to keep a portion of a pond ice-free during the winter. A small pump attached to a domestic well bringing the warmer water from below the earth's surface can also be used. Water holes for winter use do not have to be large, as waterfowl use the water mainly to drink and to warm their feet. Mechanical aquatherms, siphon jet pumps and compressed air are common automatic units used to keep water areas open during the wintertime.

Control Excess Vegetation on Wetlands

The control of excess vegetation on wetlands is beneficial to waterfowl, especially during the late summer months. Mechanical controls include (1) rotary mowing of strips or areas adjacent to ponds or pond edges during low water-level periods, (2) killing low shrub growth the season before they are to be removed by mechanical means, thus reducing the tendency to sprout, and (3) shearing off excess shrub growth projecting through the ice right after the first freezing weather occurs.

Biological methods of plant control include (1) using plant growth inhibitors to provide openings in rank growths, such as water lilies and cattails, and (2) physically "rolling" or drag-

ging down "emergent" vegetation in shallow ponds, providing open water areas and bringing seed heads down where ducks can feed on them and thus reducing the next season's plant potential.

Grazing Areas

Mow strips on land taken out of cultivation to encourage grass for waterfowl grazing. Mowed idle fields near regular feeding areas attract geese since they seek green forage for grazing. Odd strips of buckwheat adjacent to the feeding areas are also utilized.

Loafing and Nesting Islands

Loafing islands and nesting platforms should be provided in and around semi-remote water areas. Protection from land and air predators is essential. Islands and old muskrat houses are ideal. Platform nesting spots can be placed some distance from the shore on stumps circled with metal flashings or coon guards and completed with umbrellas made out of fencing, tree branches or vegetative cover.

Floating "islands" can be anchored in shallow water ponds. Metal barrels are sometimes attached underneath to adjust the height of flotation. The "islands" can be constructed from green logs with rough mitred corners made by a chain saw and held together with lag screws. Each "island" should be landscaped with a mat of reed canary grass, a willow shrub, a clump of birch, or a pfitzer juniper planting to provide shade and protection from predators.

Control Snapping Turtles

Snapping turtles sometimes become serious predators in waterfowl refuges. A good person to contact for advice about any turtle control that should be exercised is the local representative of the state game and fish department.

Extending Effect of Sanctuary

Like the Canada geese, mallards, black ducks, pintails and

other ducks have a tendency to feed in newly-harvested fields. Leasing or encouraging privately-sponsored refuge areas near feeding areas will be helpful in restoring waterfowl numbers.

PART 6. WHITE-TAILED DEER

Management Practices

1. Protect woodlands from uncontrolled fires.
2. Clear-cut small areas in larger woodlands for "clearings" and encourage sprout growth, especially soft maple.

Range

Contrary to common belief, white-tailed deer do not travel far. Studies indicate that the annual range (movement from winter to summer areas) is 1.5 miles or less for 43% of the herd. Almost 4/5 of all deer studied travel less than 6 miles. This means that deer may starve to death within what seems to be easy walking distance of available food.

Food and Cover

Deer live essentially on browse which consists of the tender sprout growth, shoots and twigs of shrubs and trees. A deer weighing 150 pounds needs at least 10-12 pounds of good browse daily to satisfy growth requirements, 8-10 pounds for maintenance.

Food preferences vary with the season. Some foods are mountain maple, hemlock, white cedar, dogwood, red maple, mountain ash, willow, viburnums, wintergreen, sweetfern, poplar, greenbrier, grass, clovers, acorns and beechnuts. Variety is essential for proper nutrition. Some plants are eaten heavily by deer, but out of necessity instead of choice. Foods such as

oaks, cherries, balsam fir, alder, spruce, pines, tamarack, rhododendron and laurel, when eaten alone and for a long duration, lead to starvation.

In overpopulated areas choice foods are often browsed out of reach of does and fawns. (Any browse over your head is generally out of reach for deer.) Special practices, such as cutting red maple, birches and hard maple in November through March to induce sprout growth, should be done where a shortage of food exists. Cut trees less than 10" in diameter because they sprout the best.

Special Food Patches

Deer will make heavy use of herbaceous forage in food strips planted on fields near woodlands. A fall or winter grain or clover field are choice foods at these locations.

Plow during late summer; apply lime, if needed; apply sufficient fertilizer (see seeding guide, Part 11); harrow and drill in 4-6 pecks of winter wheat per acre. Each of the following mixtures will plant one acre, and should be seeded on the wheat early the following spring:

Mixture #1--northern Pennsylvania and north	lbs.	Mixture #2--southern Pennsylvania and south	lbs.
Birdsfoot trefoil	4	Alfalfa	4
Alfalfa	3	Red clover	2
Alsike clover	1	White clover	4
White clover	2		
Total	10	Total	10

Pure stands of clover may be seeded instead of the suggested mixture. White clover provides excellent food for wildlife. It may be seeded alone at the rate of 2-3 pounds per acre. For other mixtures consult your local seedman, county agricultural agent or Soil Conservation Service technician.

PART 7. BOBWHITE

Management Practices

1. Plant various legumes such as vetch and certain lespedezas.

2. Provide a variety of cover in the form of wild plum thickets, tangles of grapevines over fallen trees, and brushpiles in woodland edges and fencerows.

Lespedeza

Bobwhites like the seeds of several lespedezas and find cover in some of them, both from the weather and from their enemies. The seeds of the annual lespedezas (Korean, common and Kobe) are eaten as one of several choice foods. Sericea lespedeza makes good cover for bobwhite and its seeds are occasionally eaten. The shrub or bush lespedeza is reliable bobwhite food.

Generally speaking, ordinary bicolor lespedeza is limited to areas where there is no frost before late October. Natob, another strain of bicolor, can be grown farther north because the seeds ripen earlier. Its range is roughly the western part of Virginia, West Virginia, Pennsylvania, New Jersey, southern New York to northern Massachusetts.

Japonica lespedeza fills the gap in the range between ordinary bicolor and Natob since its seeds ripen by September 25. Its range covers roughly the area between northern North Carolina to southern Pennsylvania and west to the Mississippi River.

Planting Shrub Lespedeza

Size. Approximately 1/8 to 1/4 acre in each strip.

Shape. 300-400' long, 15-20' wide, 4-6 rows. Rows should follow contour of land to prevent erosion.

Amount. One strip to each 20-25 acres.

Material. Each strip requires 1,000-2,000 plants or 2 pounds of scarified seed. Small amounts of seed can usually be obtained free of charge from soil conservation districts or the state game department. Seeds and plants are available from most commercial seed firms.

Site preparation. Plan and harrow the area the same as for any field crop. Test soil for acidity and apply lime if needed.

Setting plants. Space plants 18-24" apart in rows 3-4' apart. Set plants anytime from late fall to early spring in the south and the earlier the better. In northern states plant a suitable strain as soon as possible after frost is out of the ground.

Seeding. Use scarified seed on a well-prepared seedbed. Plant in rows (20-30 seeds per foot) or broadcast at the rate of 16 pounds per acre. Seed only when soil moisture is good and soon after the danger of killing frost is past.

Fertilizing. A liberal amount of fertilizer assures good growth and abundant seed production. The amount needed will depend on the fertility of the soil.

PART 8. RUFFED GROUSE

Management Practices

1. Protect woodlands from uncontrolled fires.
2. Create and maintain openings in woods and seed clovers in them.
3. Establish shrub borders around woodlands either by plantings or by cutting trees from edges of woods.
4. When establishing conifer plantations, leave a strip 60' wide unplanted between each strip of evergreens.

Range

Good ruffed grouse range contains three kinds of plants: (1) shrubs and low-growing ground cover for rearing broods and for summer and fall foods, (2) hardwoods for nesting and for fall, winter and spring foods, and (3) conifers or brush tangles for winter cover. All three kinds should occur within an area of 40 acres so as to be available in the daily travel limits of the birds. Under a well-planned system of rotated cuttings and forest use, all grouse requirements may well be fulfilled without extra effort.

Food

The diet of young grouse consists almost entirely of insects for the first couple of weeks. As the summer progresses they eat foods such as strawberries, raspberries and dewberries. By late summer young grouse eat the same food as adults, which consists of a great variety of buds, blossoms and fruits from wildflowers, weeds, vines, shrubs and trees.

PART 9. WILD TURKEY

Management Practices

1. Control fire in both woodlands and fields.
2. Practice selective cutting in forests to leave poorer timber sites in relatively open stands and an ample supply of food trees.
3. Mow grassy areas in late July or August.
4. Establish fruit and nut-bearing trees and shrubs along roads and around woods openings.
5. Provide an adequate water supply through development of springs, water holes and ponds.

6. Grow clover or other green winter forage in turkey range.

Cover

In good range, coniferous and hardwood forests should both be available within each 10,000 acres, which is about the smallest unit that should be considered for managing wild turkeys. Clearings should be of two types: (1) sodded areas that provide grasses and (2) openings created by clear-cut lumbering operations to provide succulent fruits and berries. Good habitat should have a clearing of 1-2 acres in every 100 acres.

Food

Acorns of almost any type often make up one-half to two-thirds of the turkey's diet. Flowering dogwood berries, beechnuts, hickory nuts, and seeds of ash and pines are also choice foods. In some localities seeds from maple, elm and birch are used in considerable quantity. Bluegrass and clover are used extensively as forage.

PART 10. MOURNING DOVE

Management Practices

1. Establish windbreaks and Christmas tree plantations for nesting sites.
2. Develop water supplies through springs, water holes and ponds.
3. Establish or maintain hedgerows.
4. Establish or maintain borders and clumps of coniferous trees.
5. Develop small sand and gravel beds where none exist.

Food

Seeds compose 99% of the mourning dove's diet. Agricultural crops in the form of waste grains and weed seeds compose the major source of food. Some of the species of plant seeds used by doves are as follows:

Crotons	Pine	Bristlegrasses
Corn	Sweetgum	Soybeans
Crabgrass	Wheat	Pokeberry
Buckwheat	Ragweed	Peanuts

Grit

Proper grit is very important in the diet of many birds and its presence can often assure the success of mourning doves. Very small, natural gravel scattered along roads and fire lanes will provide this necessity. Crushed stone and broken gravel cannot be used by doves.

PART 11. SELECTED INFORMATION

Topics

1. Seeding guide for wildlife plantings.
2. Food patch mixtures for planting in spring.
3. Where to get assistance.

(Seeding guide on next page)

Seeding Guide For Wildlife Plantings

Seed	Rate of seed per acre	Lime	Fertilizer	Size of patch	Planting time
Food patch mix #1, 2, and 3	20 lbs. per acre	according to lime requirement test for 6-6.5 pH	300-400 lbs. per acre 5-10-10	¼-1 acre	spring
Rye	3-4 pecks per acre	same	same	same	early fall
Wheat	1-1½ bu. per acre	same	same	same	same
Soybeans	1½-2 bu. per acre	same	same	up to 5 acres	late spring
Corn	10 lbs.; 40" between rows	same	400-500 lbs. per acre 5-10-10	up to 5 acres	late spring
Japanese millet	25 lbs.	same		¼-1 acre	late spring
Buckwheat	1-1½ Bu.	same	300 lbs. per acre. 5-10-10	¼-1 acre	early summer
Birdsfoot trefoil with grass	6 lbs.; with orchardgrass 3 lbs.	same	at seeding 300 lbs. per acre 5-10-10. Annual top dressing 300 lbs. 0-14-14	¼-1 acre	early spring or late summer
Sericea lespedeza	15 lbs.	maintain pH 5.8	same	long strips	spring
Bicolor lespedeza	16 lbs.	maintain pH 5.8	same	long strips	spring

Food Patch Mixtures For Planting In Spring

		lbs.
Mixture #1 for five acres:	Buckwheat	10
	Grain sorghum	9
	Foxtail millet	15
	Proso millet	15
	Kaffir	9
	Sudangrass	5
	Soybeans	15
	Cowpeas	13
	Vetch	9
		100
Mixture #2 for five acres:	Buckwheat	15
	Foxtail millet	15
	Sudangrass	15
	Soybeans	25
	Cowpeas	30
		100
Mixture #3 for ten acres:	Proso millet	35
	Grain sorghum	50
	Sunflower	15
		100

Where To Get Assistance

There are sources of information and help available to every landowner who would like to know more about the nature of soil on his property, planting dates, amount of lime and fertilizer needed for wildlife food plantings, and sources of plants and seeds that he may need.

County Agricultural Extension Service. The county extension agent's office is located in every county seat and in some cities and offers services to every landowner. The county extension agent can arrange to have soil tested to determine its fertility and its need for lime. He is a source of information on the local soil conservation districts and the state agencies (game and fish, forestry, geology, surface water control) that are available to assist a landowner. The extension agent will have the names of agencies and dealers that supply plants and seeds.

Soil Conservation District. The owner of an outdoor education area may want a soil survey and assistance in selecting, planting and managing food plots. There may be a need, too, for engineering data on dam and other water-control structures and for various fish and wildlife practices. The best and easiest way to get these services is to apply to the local soil conservation district in the county in which the area is located. These districts are local subdivisions of state government and are managed by boards of local landowners. Soil conservation districts in turn get technical help from many agencies and organizations, especially the U.S. Soil Conservation Service.

United States Government.

a. Topographic maps. These maps which show contours, elevations, waterways, roads and other information may be purchased from the U.S. Geological Survey, Washington 25, D.C. Write the agency for free index maps on which will be shown the quadrangle in which the area of concern is located. Order map by name of quadrangle and in the largest scale available. Topographic maps are also sold by some of the larger local stationery stores.

b. Aerial photographs. Prints and enlargements of most areas of the United States may be purchased. Write

for Photo Index Sheet and order form CSS-441 to the Performance and Aerial Photography Division, Commodity Stabilization Service, U.S. Department of Agriculture, Washington 25, D.C. These photos are also on file in offices of the Agricultural Stabilization and Conservation and the Soil Conservation Service in the local county seat.